

What is claimed is:

1. A sensor-incorporated wheel support bearing assembly for rotatably supporting a vehicle wheel relative to a vehicle body structure, which assembly comprises:

an outer member having a plurality of raceway grooves defined in an inner peripheral surface thereof;

an inner member having a corresponding number of raceway grooves defined therein in alignment with the respective raceway grooves in the outer member, the inner member being positioned inside the outer member with an annular bearing space defined between it and the outer member;

plural rows of rolling elements interposed between the raceway grooves in the outer member and the raceway grooves in the inner member, respectively;

sealing members for sealing opposite open ends of the annular bearing spaces between the outer and inner members; and

a load sensor disposed within the annular bearing space for detecting change in magnetic strain to thereby detect a load acting on the bearing assembly.

2. The sensor-incorporated wheel support bearing assembly as claimed in Claim 1, wherein the inner member comprises,

a hub axle and an inner race segment mounted externally on an inboard end portion of the hub axle and wherein the load sensor comprises a to-be-detected member in the form of a magnetostrictive element provided on a portion of an outer periphery of the hub axle between the inboard end portion thereof and the raceway groove, and

at least one force detecting unit provided in the outer member for detecting change in magnetic strain of the to-be-detected member.

3. The sensor-incorporated wheel support bearing assembly as claimed in Claim 2, wherein the to-be-detected member is in the form of the magnetostrictive element made of an Fe-Al alloy and the force detecting unit is in the form of a coil.

4. The sensor-incorporated wheel support bearing assembly as claimed in Claim 2, wherein the to-be-detected member is positioned substantially intermediate between the raceway grooves.
5. The sensor-incorporated wheel support bearing assembly as claimed in Claim 2, wherein the to-be-detected member includes a plurality of circumferentially extending axial grooves defined therein.
6. The sensor-incorporated wheel support bearing assembly as claimed in Claim 5, wherein each of the grooves has a depth equal to or greater than 1 mm.
7. The sensor-incorporated wheel support bearing assembly as claimed in Claim 2, wherein the force detecting unit comprises at least two force detecting elements and further comprising a circuit for detecting a magnitude of a force and a direction, in which the force acts, in reference to a detection signal outputted from each of the force detecting elements.
8. The sensor-incorporated wheel support bearing assembly as claimed in Claim 7, wherein the force detecting unit comprises at least two force detecting elements spaced from each other in a vertical direction and further comprising a circuit for detecting a force caused by a bending moment and an axially acting force separately in reference to the detection signal outputted from each of the force detecting elements.
9. The sensor-incorporated wheel support bearing assembly as claimed in Claim 2, wherein the hub axle has a cylindrical mounting region where the inner race segment is mounted, the cylindrical mounting region being undersized in diameter relative to the raceway groove 5 and being extended a distance towards an outboard side beyond an axial region where the inner race segment is seated, and further comprising a ring-shaped magnetostrictive member press-fitted onto that portion of the cylindrical mounting region of the hub axle.

10. The sensor-incorporated wheel support bearing assembly as claimed in Claim 1, further comprising a transmitting device for transmitting wirelessly a force signal detected by the load sensor.

11. The sensor-incorporated wheel support bearing assembly as claimed in Claim 1, further comprising one or both of a rotation sensor and a temperature sensor.

12. The sensor-incorporated wheel support bearing assembly as claimed in Claim 1, wherein a load signal obtained from the load sensor is utilized for an attitude control of the automotive body structure.

13. A sensor-incorporated wheel support bearing assembly for rotatably supporting a vehicle wheel relative to a vehicle body structure, which assembly comprises:

an outer member having a plurality of raceway grooves defined in an inner peripheral surface thereof;

an inner member having a corresponding number of raceway grooves defined therein in alignment with the respective raceway grooves in the outer member, the inner member being positioned inside the outer member with an annular bearing space defined between it and the outer member, the inner member comprising a hub axle and an inner race segment mounted on an inboard end portion of the hub axle;

plural rows of rolling elements interposed between the raceway grooves in the outer member and the raceway grooves in the inner member, respectively; and

a load sensor comprising a to-be-detected member in the form of a magnetostrictive element provided on a portion of an outer periphery of the hub axle between an inboard end portion of the inner race segment and the raceway groove and at least one force detecting unit provided in the outer member for detecting change in magnetic strain of the to-be-detected member.

14. The sensor-incorporated wheel support bearing assembly as claimed in Claim 13, further comprising a transmitting devices for transmitting wirelessly a force signal detected by the load sensor.

15. The sensor-incorporated wheel support bearing assembly as claimed in Claim 13, further comprising one or both of a rotation sensor and a temperature sensor.

16. The sensor-incorporated wheel support bearing assembly as claimed in Claim 13, wherein a load signal obtained from the load sensor is utilized for an attitude control of the automotive body structure.